

## PERFORMANCE SPECIFICATION SHEET

ELECTRON TUBE, CATHODE RAY  
TYPES 5AFP1 AND 5AFP7

This specification is approved for use by all Departments and Agencies of the Department of Defense.

The requirements for acquiring the electron tube described herein shall consist of this document and the latest issue of MIL-PRF-1.

**DESCRIPTION:** Dual beam, post-accelerator, flat face, electrostatic focus and deflection.

**PIN CONNECTIONS AND DIMENSIONS:** See figure 1.

**ABSOLUTE-RATINGS:**

Parameter:	Ef	Ec1	Eb1	Eb2	Eb3	ed	Rg	Zd	Ehk	Eb3/Eb2	Alt
Unit:	V	V dc	V dc	V dc	V dc	v	Meg	Meg	V dc	Ratio	ft
Maximum:	6.9	0, -200	1,750	3,500	10,500	750	1.5	1.0	±180	3.0	50,000
Minimum:	5.7	---	---	1,000 <sup>1/</sup>	1,000	---	---	--- <sup>2/</sup>	---	--- <sup>3/</sup>	---
Test conditions: <sup>4/</sup>	6.3	Adjust	Focus	2,000	4,000	---	---	1.0	---	2.0	---

See footnotes at end of table I.

**GENERAL:**

Qualification: Required.

TABLE I. Testing and inspection.

Inspection	Method	Conditions	Symbol	Limits		Unit
				Min	Max	
<u>Qualification inspection</u>						
Base material insulating quality	1216		---	---	---	---
Neck and bulb alignment (electrostatic types)	5101		Dia	---	3.31	inch
Face tilt	5101		---	---	---	---
Cathode illumination	5216		---	---	---	---
Barometric pressure, reduced	1002	87 mmHg <u>6/</u>	---	---	---	---
Pressure (implosion)	1141		---	---	---	---
Vibration	5111		Width	---	1	mm
Direct-interelectrode capacitance	1331	<u>12/</u>				
		k to all	Ck	---	4.6	pF
		g1 to all	Cg1	---	4.0	pF
		D1 to D2	C1D2	---	2.0	pF
		D3 to D4	C3D4	---	1.4	pF
		D1 to all	CD1	---	5.0	pF
		D2 to all	CD2	---	5.0	pF
		D3 to all	CD3	---	4.1	pF
D4 to all	CD4	---	4.1	pF		
Deflection-factor uniformity	5248	1D2	---	---	2	%
		3D4	---	---	3	%
Interaction factor	5250		---	---	$14 \times 10^{-6}$	Inch/V dc
Magnetization	5256		---	---	---	---
<u>Conformation inspection</u> <u>part 1</u>						
Voltage breakdown	5201		---	---	---	---
Voltage breakdown (electrostatic types)	5201		---	---	---	---
Gas "cross"	5206	lb3 = 50 $\mu$ A dc <u>5/</u>	---	---	---	---
Modulation	5223	lb3 = 25 $\mu$ A dc	$\Delta E_{c1}$	---	35	V dc
Spot position (electrostatic deflection)	5231		---	---	15	mm
Spot displacement (leakage)	5231		Displ	---	10	mm
Grid cutoff voltage	5241		Eco	-45	-75	V dc
Tracking	---	<u>9/</u>	---	---	1.5	%
Useful scan	---	1D2 <u>10/</u>	---	---	4	inch
		3D4 <u>10/</u>	---	---	4	inch

See footnotes at end of table.

TABLE I. Testing and inspection - Continued.

Inspection	Method	Conditions	Symbol	Limits		Unit
				Min	Max	
<u>Conformance inspection, part 1</u> - Continued						
Pattern distortion	5103	11/	---	---	2	%
Grid No. 1 leakage current	5251		---	---	---	---
Anode No. 1 leakage current	5251		Ib1	---	3	μA dc
Anode No. 2 leakage current	5251		---	---	---	---
Light output (P1)	5221	Ib3 = 25 μA dc 5/	Light	20	---	fL
<u>Conformance inspection, part 2</u>						
Heater current	1301		If	540	660	mA
Electrode currents (Anode No. 1)	5201		Ib1	-10	5	μA dc
Electrode current (cathode)	5201	Ib3 = 50 μA dc	Ik	---	600	μA dc
Base alignment (electrostatic types)	5101	+3D4, base key, collar index pin	---	---	---	---
Collar base alignment	---	+3D4, collar index pin	---	---	10	Degrees
Side terminal and base alignment	5101	Base key, collar index pin	---	---	---	---
Side terminal alignment (electrostatic types)	5101	+3D4	---	---	---	---
Neck and base alignment (electrostatic types)	5101		---	---	---	---
Screen (P7)	5221	5/	---	---	---	---
Line width B (electrostatic deflection)	5226	Ib3 = 25 μA dc	Width	---	0.69	mm
Focusing voltage at modulation condition	5246		Eb1	---	610	V dc
Angle between traces	5101		---	89	91	Degrees
Bulb, screen, and faceplate quality	5106		---	---	---	---
Trace alignment (gun to gun)	---	7/	---	---	---	---
Stray light emission (conventional types)	5216	Eb2 = 3,500 V dc; Eb3 = 10,500 V dc	---	---	---	---

See footnotes at end of table.

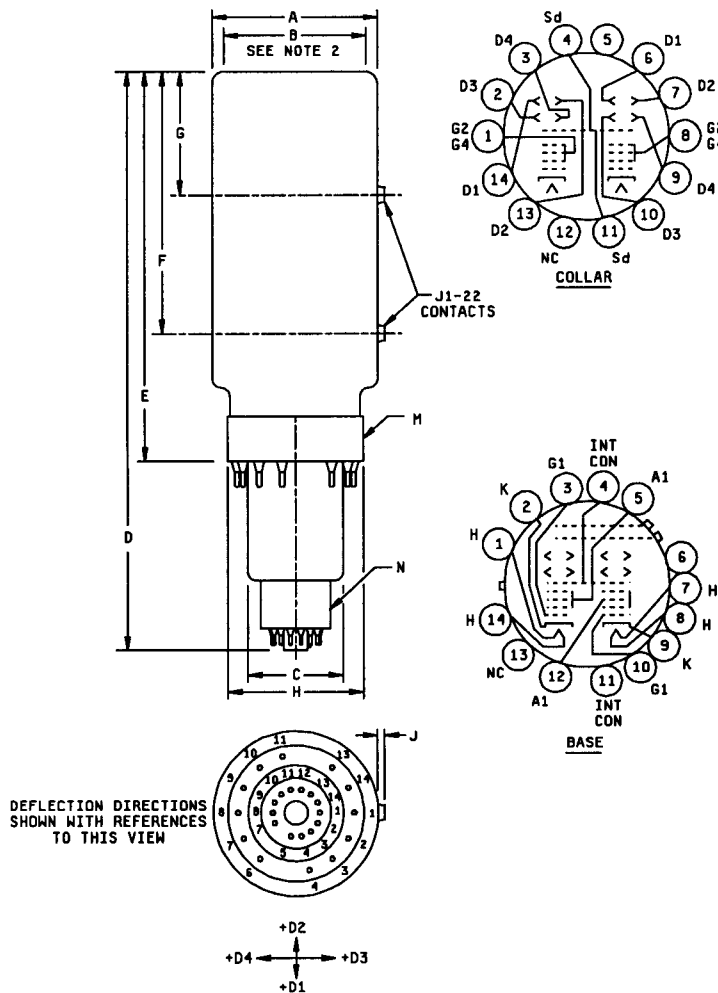
TABLE I. Testing and inspection - Continued.

Inspection	Method	Conditions	Symbol	Limits		Unit
				Min	Max	
<u>Conformance inspection, part 2</u> - Continued						
Line width A (electrostatic deflection)	5226	lb3 = 25 $\mu$ A dc	Width	---	0.65	mm
Focusing voltage at cutoff	5246		Eb1	---	610	V dc
Deflection factor	5248	1D2 $\frac{g}{\text{inch}}$	DF	54	66	V dc/inch
Deflection factor	5248	3D4 $\frac{g}{\text{inch}}$	DF	43	53	V dc/inch
Deflection factor	5248	1D2; Eb3 = Eb2 = 2,000 V dc	DF	43	55	V dc/inch
Deflection factor	5248	3D4; Eb3 = Eb2 = 2,000 V dc	DF	36	44	V dc/inch
Heater-cathode leakage current	5251		lhk	---	15	$\mu$ A dc
Secureness of base, cap, or insert	1101		---	---	---	---
Base pin solder depth	1111		---	---	---	---
Permanence of marking	1105		---	---	---	---
<u>Conformance inspection, part 3</u>						
Life-test provisions	---	Group C; t = 500 hours (min); lb3 = 25 $\mu$ A dc; Eb2 = 3,500 V dc; Eb3 = 10,500 V dc	---	---	---	---
Life-test end points	---	lb3 = 18.75 $\mu$ A dc				
		Modulation	$\Delta E_c$	---	35	V dc
		Line width A	Width	---	0.65	mm
		Line width B	Width	---	0.75	mm
		Grid No. 1 leakage	---	---	---	---
		Anode No. 2 leakage	---	---	---	---
		Heater-cathode leakage	---	---	---	---
		Anode No. 1 leakage	---	---	---	---
Stray emission	---	---	---	---	---	

See footnotes at top of next page.

TABLE I. Testing and inspection - Continued.

- 1/ Accelerator average power input shall be limited to 6 watts. Grid No. 4 and grid No. 2 are connected internally and referred to herein as accelerator. This shield and the accelerator electrodes should be connected together under normal operating and test conditions. However, the accelerator as well as the first ring of the post-deflection accelerating system may be operated at slightly different potentials for astigmatism control if desired and the shield potential should then be adjusted for optimum performance.
- 2/ Deflection electrode circuit resistances should be equal. Higher resistance values up to 5.0 megohms may be used for low-beam current operation.
- 3/ This tube is designed for optimum performance when operating at an Eb3/Eb2 ratio of 2.0. Operation at other ratios of Eb3/Eb2 may result in changes in deflection uniformity, pattern distortion, and tracking.
- 4/ All tests except capacitance, vibration, tracking, cathode illumination, stray emission, and interaction factor shall be made on each unit separately. Each deflection plate shall be connected to A2 through a resistance of 1 megohm.
- 5/ This test to be performed at the conclusion of the holding period.
- 6/ Maximum potentials applied to base, deflection plates, and A2 only.
- 7/ Corresponding traces of each unit shall be within 1° of each other.
- 8/ The ratio of the deflection factors of corresponding deflection electrodes shall not exceed 1.15.
- 9/ The focused spots of both guns shall be moved by means of a common dc voltage along the 1D2 axis until the spot of gun A is at  $\pm 1$  inch from the geometrical center of the tracking area. Then by means of a small correction voltage, the spot of gun B shall be moved to the same distance. The spots then shall be moved by means of the common dc voltage in the opposite direction from the geometrical center until the spot of the less sensitive gun reaches -1 inch. The difference in deflection factor of the more sensitive gun is then compensated for by moving its spot back to -1 inch by means of a voltage divider. This entire procedure is to be duplicated along the 3D4 axis. Then by means of the two common dc voltages, the spots shall be tracked over the entire tracking area, a 4-inch diameter circle centered with respect to the tube face center, and the greatest distance between the spots shall not exceed the limit specified.
- 10/ Centered with respect to the tube face and with the tube shielded.
- 11/ With a raster pattern, adjusted so its widest points just touch the sides of a 3.060-inch square, will fall within the area bounded by the 3.060-inch square and an inscribed 2.940-inch square.
- 12/ All other electrodes contained within the envelope are to be tied together.



## NOTES:

1. Shield (collar pins 4 and 11) is common to both beams.
2. Minimum useful screen diameter.

Ltr	Dimensions			
	Inches		Millimeters	
	Min	Max	Min	Max
Conformance inspection, part 2				
A	5.16	5.37	130.97	135.73
B	4.50	---	114.30	---
C	2.94	3.06	74.61	77.79
D	18.00	18.50	457.20	469.90
E	12.00	12.50	304.80	317.50
F	7.75	8.25	196.85	209.55
G	3.44	3.94	87.31	100.01
H	4.25	4.375	107.95	111.13
J	---	.125	---	3.18
Conformance inspection, part 3 (periodic check)				
K	Envelope: J42R1, J42S1			
L	Contact: J1-22			
M	Collarbase: A12-94			
N	Base: B12-37			

FIGURE 1. Outline drawing of electron tube types 5AFP1 and 5AFP7.

Custodians:

Army - CR  
Navy - EC  
Air Force - 11  
DLA - CC

Preparing activity:

DLA - CC

(Project 5960-3551-20)

Review activities:

Navy - AS, CG, MC, OS  
Air Force - 17, 19